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# Landslide and alluvial hazard high-resolution mapping of the Somma-Vesuvius volcano by means of DTM, remote sensing, geophysical and geomorphological data GIS-based approach

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ABSTRACT

Lo scopo di questo lavoro è quello di identificare e mappare le aree del complesso vulcanico Somma-Vesuvio, prossime a franare attraverso un'analisi multidisciplinare, utilizzando dati geomorfologici, geologici e geofisici, storici e recenti. In particolare le mappe ottenute sono necessarie per identificare la future aree di inondazione e perciò utili a poter stabilire un possibile scenario di rischio idrogelogico del distretto vulcanico.

KEY WORDS*: DTM, GIS, Lahar, Landslides, Somma-Vesuvius.*

## INTRODUCTION

The aim of this paper is to recognize and map the Somma-Vesuvius volcano landslide-prone areas by means of multi-disciplinary terrain analysis and classification; in detail, high-resolution DTM of landslides areas occurred over long time periods, remote sensing, and geophysical and geomorphological data are presented for assessing hydrogeological hazard parameters of this volcanic district.

The Somma-Vesuvius volcano, due to its explosive volcanism and the dense urbanization of the surrounding area with a population exceeding 650,000, is one of the most dangerous active volcanoes of the world. The main hazard of the perivolcanic area is associated to effusive eruptions and explosive Plinian and sub-Plinian eruptions, alternated to long-lasting quiescence periods.

Moreover, additional hazard is related to lahars: flows of unconsolidated debris and water that typically include fragments of volcanic origin, colluvium, and soil. The features of lahars can range from debris flow to hyperconcentrated flow. The most important lahars phenomena of the Somma-Vesuvius occurred with the main historical eruptions of 79 A.D., 472 A.D., and 1631 (MASTROLORENZO *et alii*, 2002; ROSI *et alii*, 1993; ROSI *et alii*, 1996). Recently, remobilization of the pyroclastic cover has produced several debris flows and alluvial phenomena that invaded the surrounding plains affecting towns and roads.

## METHODOLOGY

Our methodological approach is based on landslides data recognizing and mapping both from geological maps, papers, historical chronicles, and from aerial photos, orthophoto, and available DTM image analysis of the Somma-Vesuvius complex (fig.1). Through detailed study of this material the main landslides depositional areas have been surveyed; moreover, other geophysical and geomorphological parameters have been considered jointly with the landslides occurrence in order to correlate and interpret the soil movements phenomena. The analysis of several space-time series of data, together with the updated territorial information has been carried out through the Geographic Information System (GIS) (software ArcGIS 9.3), in order to store, manage and process large amount of spatial data.

Finally, the achievement of landslide hazard high-resolution mapping of the Somma-Vesuvius volcano is performed in this paper through investigation of the flowslides deposits (lahar) of this area (DI CRESCENZO *et alii*, 2008).

Actually, the recent heavy urbanization of landslide-prone areas

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has increased their vulnerability, consequently buildings and infrastructure could be seriously damaged and safety of the people endangered (DAVOLI *et alii*, 2001).

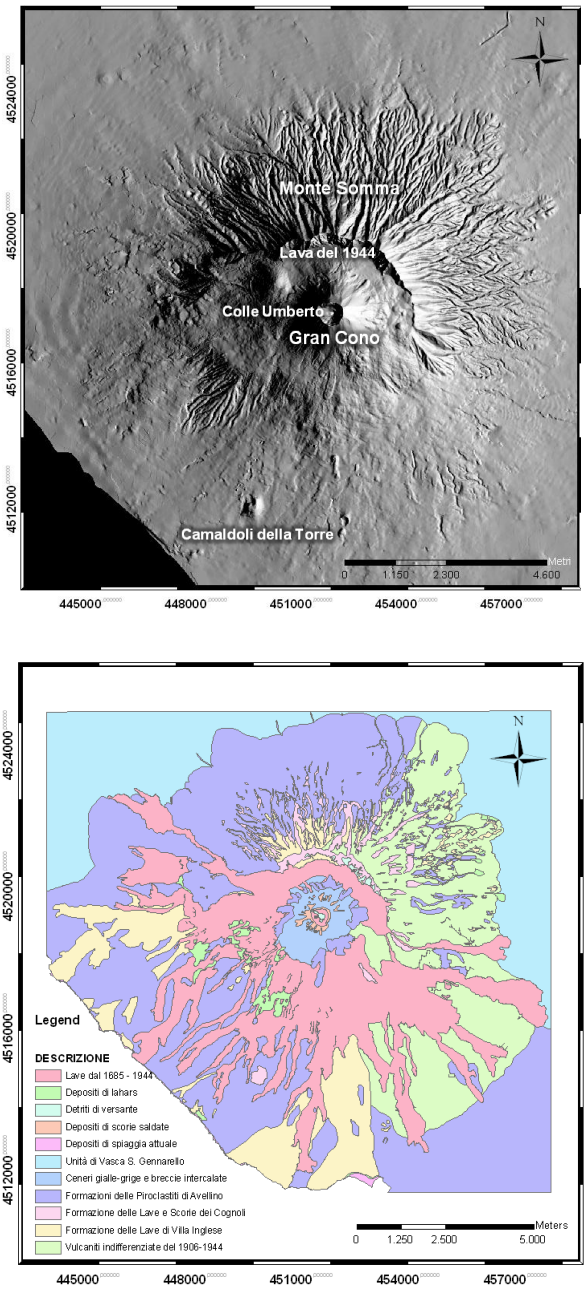


*Fig. 1* – The fig. 1 shows the shaded relief of Somma-Vesuvius volcanic complex (on the top) and geological map modified from SANTACROCE *et alii*, 2003 (on the bottom).

Therefore the obtained maps are necessary for identifying the future inundation areas and for evaluating the possible hydrogeological risk scenarios.

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